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Abstract

Previous research indicated that a past history of reinforcement affects perception, but conflicting data were found concerning the effect of punishment. These experiments were testing the theory of signal detection, which holds that a past history of reinforcement when linked with a signal makes perception of that signal more likely in the future. Eighty eight students from introductory psychology classes at the University of Richmond participated. Subjects looked at inkblots and made responses on a human operant apparatus. In Experiment 2 an analysis of variance revealed a significant difference in the perception of human forms in ambiguous inkblots after a past history of reinforcement. No significant difference was found on the individual categories or the overall rate of response from pretest to post test. Follow up research indicated was the use of a t-scope for the presentation of the inkblots.

The Effect of a Past History of Reinforcement on Signal Detection

Several positions concerning perceptual development have been espoused by theorists. The nativists position holds that man is born with certain capacities, while the empirical position states that man's mind is a tabula rosa on which experience writes (Calfee, 1975). Neither position, however, has been sufficient to explain perceptual development, but such development appears to begin at an early age. Infants of 4-, 10-, and 16-weeks were shown 7 pictures of faces ranging from realistic to scrambled (Wilcox, 1969). The infants showed a preference to the more complex and realistic pictures by attending to them longer than to the others. Perceptual experiences can occur within the realm of any of the senses. They are seldom, however, experienced as a single sensation but rather as a sensation perceived relative to a background of other sensations (Osgood, 1968).

Proshansky and Murphy (1942) delved into the problems of whether or not perception is determined by past history and present attitudes. They used three categories of lines labeled long, intermediate, and short and three categories of weights labeled large, intermediate, and small. During pre-training the subjects were asked to estimate lengths and weights. As expected, lines were judged to be longer and weights heavier than in the pre-test period. This

finding lended support to the hypothesis that perception is affected by a past history of reinforcement.

Smith and Hochberg (1950) studied the effect of punishment upon perception. Two solid white and two solid black faces were produced singlely onto slides for a training series and in two combinations of a black and white figure for a test series. One group was shocked for the presentation of one pair and the other group for the presentation of the other pair. Both groups displayed greater perception of unshocked than of shocked faces, indicating that past history influences detection and that punishment adversely affects perception.

Rock and Fleck (1954) studied the effect of past history of reward and punishment upon perception. They used four different profile faces. One group was rewarded for two of the faces and the other group punished for the presentation of those faces and vice-versa. For the post-training an ambiguous situation of one previously rewarded and one previously punished face was created. The subject was to respond with the correct name of the face. This study indicated that there was no significant difference between the perception of rewarded and punished faces.

The purpose of this study was to test the theory of signal detection. This theory holds that a past history of reinforcement when linked with a certain signal will make one more likely to perceive that signal in the future.

The first hypothesis was that the experimental groups would perceive more human forms in the test section than the control group. The second hypothesis was that within each category, the experimental groups would perceive more human forms in the post test except for the category termed non-ambiguous non-human in which experimental Group I was punished. The third hypothesis was that the experimental groups would have an overall response rate that would be significantly higher than the control group for the perception of human forms.

Experiment 1

Method

Subjects. Forty students from the introductory psychology classes at the University of Richmond participated in the experiment. Subjects were randomly assigned to the groups, 14 subjects in experimental Group I and 13 each in experimental Group II and in the control group. The age range of the subjects was from approximately 18 to 22 years.

Apparatus. A human operant apparatus made by the Lafayette Instrument Company, model no. 58005 and serial no. 147396, was used. The apparatus allowed the experimenter to set the reinforcement schedule. Upon pressing a small lever, a M&M dropped from a dispenser according to the predetermined schedule.

Procedure. In the pilot study a number of subjects were shown cards with inkblots and were asked to determine whether or not they perceived a human form, either the head or the entire body. From these responses the inkblot cards were divided into three categories: (1) those in which 70% of the people perceived a human form, termed non-ambiguous human, (2) those in which 70% did not perceive a human form, termed non-ambiguous non-human, (3) and those in which responses were almost evenly divided, termed ambiguous.

This experiment made use of the results found in the pilot study. Fifteen inkblots from each category were randomly selected, and then these 45 cards were randomly positioned for the pretest. This positioning remained fixed throughout the experiment. Subjects were asked to read and to sign the consent forms (see Appendix A). After the experimenter read the instructions, each of the 45 inkblots were shown one by one (see Appendix B and Appendix C). The experimenter then recorded each response on an answer sheet (see Appendix D). Instructions for a two minute vigilance task were read (see Appendix E). Upon completion of this task, instructions were read for the test of 15 inkblots randomly selected from the cards remaining in the ambiguous category (see Appendix F).

The experimenter recorded responses for the post test beside the responses for the pretest.

Results

A one-way analysis of variance using the completely randomized design was done on the test section, but no significant increase in perception of human forms was demonstrated by the experimental groups. A two-factor mixed design, repeated measures analysis was performed on each of the three categories, non-ambiguous human, non-ambiguous non-human, and ambiguous, with no significant findings. The final analysis used a one-way completely randomized design to test for a significant change in response from the pretest to the post test. Again, no significant results were found. All analyses were performed at the .05 level of confidence.

Experiment 2

Method

Subjects. Forty eight students from the introductory psychology classes at the University of Richmond participated in the experiment. Experimental Group I consisted of 15 subjects, experimental Group II of 15 subjects, and the control group of 18 subjects. The age range of the subjects was from approximately 18 to 22 years.

Apparatus. The same apparatus was used as in the first experiment. The only difference was that marbles were used rather than M&Ms.

Procedure. After reading and signing the consent form, the subjects were given an answer sheet on which they recorded whether or not they pressed the key on the human operant apparatus (see Appendix G). The experimenter had a different answer sheet which was coded to identify the category to which each inkblot card belonged (see Appendix H). The experimenter then read the instructions (see Appendix I). The apparatus except the key press and the dispenser were behind a screen to enable the experimenter to make adjustments without the subject's knowledge. The experimenter presented the cards in the prearranged order. The timer was set on the machine so that the subject had 3 seconds to respond before the presentation of the next card.

Experimental Group II received reinforcement for every key press; one marble fell from the dispenser. At the close of the first part of the experiment each marble was exchanged for a nickel. Experimental Group I received reinforcement for every key press except when responding to non-ambiguous non-human inkblots. Responses to these cards were punished by the removal of one marble from the subject's collection. Before the presentation of a non-ambiguous non-human card, the experimenter turned the machine off to prevent a marble from falling if the key was pressed by a subject in experimental Group I. The machine was set so that the control group received no reinforcement

regardless of the response. After receiving payment if appropriate, subjects were read further instructions (see Appendix J). Upon completion of the second part of the experiment, subjects were debriefed (see Appendix K).

Results

A one-way analysis of variance using the completely randomized design was performed on the test section, which consisted of 15 ambiguous cards, and significant results were found. When a two-factor mixed design,

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Insert Table 1 about here

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repeated measures was done on the three different categories of cards, no significant results were found. The one-way completely randomized design revealed no significant changes in overall response from the pretest to the post test. All analyses were again done at the .05 level of confidence.

Discussion

The theory of signal detection was only partially supported by the results found in the experiments. The hypotheses that the experimental groups would perceive more human forms in the test section of ambiguous cards after a history of reinforcement had significant results in Experiment 2. No significant difference was found in the perception of human forms in the groups from the

pretest in which reinforcement was given the experimental groups to establish the past history of reinforcement and the post test. There was no significant difference found within or between the groups for any of the three categories of cards, non-ambiguous human, non-ambiguous non-human, or ambiguous. No significant difference was found in the overall perception of human forms from the pretest to the post test.

Experiments 1 and 2 involved the same hypotheses, the only changes being in the procedure. Six cards, 2 from each category were placed at the beginning of Experiment 2 to allow the subject a quick preview of the pretest. These 6 cards were not included in the analysis. To eliminate confusion and fatigue for the experimenter, two separate answer sheets were made for Experiment 2. In Experiment 1 the experimenter had to present the inkblot cards, regulate the machine, and record the subject's response. In Experiment 2 subjects were allowed to record their own responses, and the experimenter presented the cards and regulated the machine by following the code on the experimenter answer sheet. In Experiment 1 the experimenter set behind the machine, but a screen was added to Experiment 2 to ensure that the subject could not see the experimenter cutting the machine on and off. The vigilance task seemed to serve no real purpose, so it was eliminated from Experiment 2. Monetary reinforcement was added to

Experiment 2 because it seemed a more universal reinforcer. The same instructions were given to all groups in Experiment 2 to ensure that any changes in perception of human forms would be due to the reinforcement schedules rather to the instructions.

The experimenter attempted to treat all subjects uniformly and to make no comments during the experiment. The experimenter avoided eye contact with the subjects during the presentation of the inkblot cards to prevent any non-verbal reinforcement. The room in which Experiment 1 was set up was small, cluttered, and often hot, but all subjects had to endure these conditions. The set up for Experiment 2 was in a large, new, and comfortable room.

Follow up research might involve 3 trials of the original 45 inkblot cards for each of the three groups. On the first trial no subject would receive reinforcement, then the same procedures as found in Experiment 2 could be followed for the other two trials. Other research might also include the use of a t-scope to present the inkblots.

References

Calfee, R. Human Experimental Psychology. New York: Holt, Rinehart, and Winston, 1975.

Osgood, C. Methods and Theory in Experimental Psychology. New York: University Press, 1968.

Proshansky, H. & Murphy, G. The Effects of Reward and Punishment. Journal of Psychology, 1942, 13, 295 - 305.

Rock, I. & Fleck, F. A Re-examination of Monetary Reward and Punishment on Figure-Ground Perception. Journal of Experimental Psychology, 1950, 766 - 776.

Smith, D. & Hochberg, J. The Effect of "Punishment" (Electric Shock) on Figure-Ground Perception. Journal of Psychology, 1954, 38, 83 -87.

Wilcox, B. Visual Preference of Human Infants for Representation of the Human Face, Journal of Experimental Psychology, 1967, 7, 10 - 30.

Table 1

Analysis of Variance

Experiment 2

Source	SS	df	ms	F	p
Total	402	47			
Between Groups	177	2	88.5	17.7	$<.05$
Within Groups	225	45	5		

Appendix A: Consent Form

This task will involve looking at inkblots. Each time I see a human foem, I am to press a key. If my response is accurate, I will be rewarded.

All my responses will be confidential and I can terminate participation at any time.

I am aware of what this experiment entails and I volunteer to participate.

_____ _____

Signature Date

Appendix B: Instructions for Experimental Groups

This is like a game. We want to see how many M&Ms you can accumulate. Previous research has shown that people who are socially perceptive earn more M&Ms. I'm going to show you cards with inkblots on them. If you perceive a human form (either the head or entire body), press this key like this (demonstrate). If your response agrees with the majority of people who have been shown the cards before, (70%), you will be correct and will receive a M&M. <u>If your response is not in agreement with the majority, (70%), I will take a M&M away</u>.* Do you understand? The object is to accumulate as many M&Ms as possible.

* <u>Note</u>. Delete the underlined sentence for experimental Group II.

Appendix C: Instructions for Control Group

This is like a game. We want to see how many M&Ms you can accumulate. Previous research has shown that people who are socially perceptive earn more M&Ms. I'm going to show you cards with inkblots on them. If you perceive a human form (either the head or the entire body), press this key like this (demonstrate). If your response agrees with the majority of people who have been shown the cards before, (70%), you will be correct and will receive a M&M. Do you understand? The object is to accumulate as many M&Ms as possible.

Appendix D : ANSWER SHEET

Record a ✓ For a Key Press and A X For No Press.

+45B.
43B.
+36B.
12A.
15A.
41B.
+34B.
19A.
27A.
+22B.
42B.
34A.
35B.
+21B.
Y.
6B.
+16B.
5B.
+ X.
1B.
3B.
+44A.
4B.
42A.

+41A.
7B.
33A.
30A.
+21A.
9B.
28A.
+18A.
24A.
+6A.
14B.
19B.
20A.
+ 2A.
25B.
13A.
+ 1A.
Y.
11A.
+ 4A.
38A.

TEST ONLY
+14A.
+16A.
+22A.
+25A.
+31A.
+32A.
+40A.
+45A.
+ 2B.
+ 8B.
+12B.
+29B.
+32B.
+39B.
+32C.

Appendix E: Instructions for Vigilance Task

This is a task that previous research has shown to be related to perserverence. You are to cross out the articles that you see in the follwoing passage. People with better perserverence are more accurate. Please cross out all the articles (the, a , an, etc.) in this passage. You will have two minutes. Any questions?

Appendix F: Instructions for Test Trial

As a last check on the perception of human forms we want you to again designate whether you perceive a human form in the following cards by pressing the key. Any questions?

Appendix G: ANSWER SHEET

Record a ✓ for each key press and a X for no key press.

1.	23.	45.	67.	89.
2.	24.	46.	68.	90.
3.	25.	47.	69.	91.
4.	26.	48.	70.	92.
5.	27.	49.	71.	93.
6.	28.	50.	72.	94.
7.	29.	51.	73.	95.
8.	30.	52.	74.	96.
9.	31.	53.	75.	97.
10.	32.	54.	76.	98.
11.	33.	55.	77.	99.
12.	34.	56.	78.	100.
13.	35.	57.	79.	101.
14.	36.	58.	80.	102.
15.	37.	59.	81.	103.
16.	38.	60.	82.	104.
17.	39.	61.	83.	105.
18.	40.	62.	84.	106.
19.	41.	63.	85.	107.
20.	42.	64.	86.	108.
21.	43.	65.	87.	109.
22.	44.	66.	88.	110.
				111.

Appendix H: ANSWER SHEET

Record a √ for each key press and a X for no key press.

\+ = ambiguous; ___ = non-ambiguous non-human; other indicates n-a human

	1. 24B	(83)	23. 16B+	(105)	45. 25B		
	2. 40B	(84)	24. 5B	(106)	46. 13A		
	3. 28B	(85)	25. X+	(107)	47. 1A+		
	4. 11B	(86)	26. 1B	(108)	48. Y		
	5. 7A	(87)	27. 3B	(109)	49. 11A		
	6. 43A	(88)	28. 44A+	(110)	50. 4A+		
(67)	7. 45B+	(89)	29. 4B	(111)	51. 38A		
(68)	8. 43B	(90)	30. 42A		52. 14A+		
(69)	9. 36B+	(91)	31. 41A+		53. 16A+		
(70)	10. 12A	(92)	32. 7B		54. 22A+		
(71)	11. 15A	(93)	33. 33A		55. 25A+		
(72)	12. 41B	(94)	34. 30A		56. 31A+		
(73)	13. 34B+	(95)	35. 21A+		57. 32A+		
(74)	14. 19A	(96)	36. 9B		58. 40A+		
(75)	15. 27A	(97)	37. 28A		59. 45A+		
(76)	16. 22B+	(98)	38. 18A+		60. 2B+		
(77)	17. 42B	(99)	39. 24A		61. 8B+		
(78)	18. 34A	(100)	40. 6A+		62. 12B+		
(79)	19. 35B	(101)	41. 14B		63. 29B+		
(80)	20. 21B+	(102)	42. 19B		64. 32B+		
(81)	21. Y	(103)	43. 20A		65. 39B+		
(82)	22. 6B	(104)	44. 2A+		66. 38B+		

Appendix I: Instructions for Pretest

This is like a game. We want to see how many marbles you can accumulate. Previous research has shown that people who are socially perseptive earn more marbles. I'm going to show you cards with inkblots on them. If you perceive a human form (either the head or the entire body) anywhere in the inkblot (the entire inkblot or any part of it) press this key lightly like this (demonstrate). If your response agrees with a majority (70%) of the people who have been shown the cards before, you will receive a marble. If your response is not in agreement with the majority, I will take a marble away. Each marble is worth a nickel. Do you understand? The object is to accumulate as many marbles as possible.

Appendix J: Instructions for Test Trial

As a last check on the perception of human forms, we want you to again designate whether you perceive a human form in the following cards by pressing the key. This time there will be no marbles coming out of the machine regardless of the response. Any questions?

Appendix K: DEBRIEFING

This experiment is not really concerned with social perception, but rather we are testing the theory of signal detection. Our hypothesis is that a past history of reinforcement when that reinforcement is linked with a certain signal will make one more likely to detect that signal in the future. We are also testing for any effects that punishment may have.

The inkblots have been divided into three categories according to responses from the pilot study: non-ambiguous non-human cards, non-ambiguous human cards, and ambiguous cards. The control group receives no reinforcement regardless of the response made while one of the experimental groups receives reinforcement for every response made. The other experimental group receives reinforcement for every response except responses to non-ambiguous non-human cards for which they are punished by the removal of one of their marbles.

If the hypothesis is supported the experimental groups would be expected to perceive more human forms than the control group in the test section which consists of 15 ambiguous cards. The experimental groups should also perceive more human forms on the second showing of the 45 original cards. The control group would be expected to respond about the same as the first time.